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Pest categorisation of *Citripestis sagittiferella*

EFSA Panel on Plant Health (PLH),
Claude Bragard, Katharina Dehnen-Schmutz, Francesco Di Serio, Paolo Gonthier, Marie-Agnès Jacques, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe Lucien Reignault, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen, Lucia Zappalà, Chris Malumphy, Ewelina Czwienczek, Virag Kertesz, Andrea Maiorano and Alan MacLeod

Abstract

The EFSA Panel on Plant Health performed a pest categorisation of the citrus pulp borer, *Citripestis sagittiferella* (Lepidoptera: Pyralidae), for the EU. This oligophagous species, which feeds on *Citrus* spp., occurs in Southeast Asia, mostly in lowlands but can also be found up to 1,200 m above sea level. Adults oviposit on citrus fruit at any stage of the fruit development. Larvae feed in the fruit then abandon it to pupate in the soil within an earthen cocoon. *C. sagittiferella* is multivoltine in its native range. This species is not included in EU Commission Implementing Regulation 2019/2072. Potential entry pathways for *C. sagittiferella*, such as *Citrus* spp. plants for planting with foliage and soil/growing medium, and soil/growing medium by themselves can be considered as closed. The citrus fruit pathway remains open for countries where *C. sagittiferella* is known to occur. Indeed, this species was intercepted several times in the UK during the last decade. Hosts of *C. sagittiferella* are available (*Citrus* spp.) in the southern EU. The EU has climatic conditions that are also found in countries where *C. sagittiferella* occurs although it is unknown whether *C. sagittiferella* occurs in those areas. Economic impact in citrus production is anticipated if establishment and spread occur. *C. sagittiferella* satisfies the criteria that are within the remit of EFSA to assess for this species to be regarded as a potential Union quarantine pest. There is uncertainty about the climatic requirements of this species, which may hamper its establishment in the EU.

Keywords: citrus pulp borer, pest risk, plant health, plant pest, quarantine

Requestor: European Commission

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Correspondence: alpha@efsa.europa.eu

Panel members: Claude Bragard, Katharina Dehnen-Schmutz, Francesco Di Serio, Paolo Gonthier, Marie-Agnès Jacques, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe L Reignault, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen and Lucia Zappalà.

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1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031, on the protective measures against pests of plants, is applying from 14 December 2019. Conditions are laid down in this legislation in order for pests to qualify for listing as Union quarantine pests, protected zone quarantine pests or Union regulated non-quarantine pests. The lists of the EU regulated pests together with the associated import or internal movement requirements of commodities are included in Commission Implementing Regulation (EU) 2019/2072. Additionally, as stipulated in the Commission Implementing Regulation 2018/2019, certain commodities are provisionally prohibited to enter in the EU (high-risk plants, HRP). EFSA is performing the risk assessment of the dossiers submitted by exporting to the EU countries of the HRP commodities, as stipulated in Commission Implementing Regulation 2018/2018. Furthermore, EFSA has evaluated a number of requests from exporting to the EU countries for derogations from specific EU import requirements.

In line with the principles of the new plant health law, the European Commission with the Member States are discussing monthly the reports of the interceptions and the outbreaks of pests notified by the Member States. Notifications of an imminent danger from pests that may fulfil the conditions for inclusion in the list of the Union quarantine pest are included. Furthermore, EFSA has been performing horizon scanning of media and literature.

As a follow-up of the above mentioned activities (reporting of interceptions and outbreaks, HRP, derogation requests and horizon scanning), a number of pests of concern have been identified. EFSA is requested to provide scientific opinions for these pests, in view of their potential inclusion by the risk manager in the lists of Commission Implementing Regulation (EU) 2019/2072 and the inclusion of specific import requirements for relevant host commodities, when deemed necessary by the risk manager.

1.1.2. Terms of Reference

EFSA is requested, pursuant to Article 29(1) of Regulation (EC) No 178/2002, to provide scientific opinions in the field of plant health.

EFSA is requested to deliver 53 pest categorisations for the pests listed in Annex 1A, 1B, 1D and 1E (for more details see mandate M-2021-00027 on the Open.EFSA portal). Additionally, EFSA is requested to perform pest categorisations for the pests so far not regulated in the EU, identified as pests potentially associated with a commodity in the commodity risk assessments of the HRP dossiers (Annex 1C; for more details see mandate M-2021-00027 on the Open.EFSA portal). Such pest categorisations are needed in the case where there are not available risk assessments for the EU.

When the pests of Annex 1A are qualifying as potential Union quarantine pests, EFSA should proceed to phase 2 risk assessment. The opinions should address entry pathways, spread, establishment, impact and include a risk reduction options analysis.

Additionally, EFSA is requested to develop further the quantitative methodology currently followed for risk assessment, in order to have the possibility to deliver an express risk assessment methodology. Such methodological development should take into account the EFSA Plant Health Panel Guidance on quantitative pest risk assessment and the experience obtained during its implementation for the Union candidate priority pests and for the likelihood of pest freedom at entry for the commodity risk assessment of High Risk Plants.

1.2. Interpretation of the Terms of Reference

Citripestis sagittiferella is one of a number of pests listed in Annex 1 to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a regulated pest for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores, and so inform European Commission decision-making as to its appropriateness for potential inclusion in the lists of pests of Commission Implementing Regulation (EU) 2019/2072. If a pest fulfils the criteria to be potentially listed as a regulated pest specific import requirements for relevant host commodities will be identified; for pests already present in the EU additional risk reduction options will be identified.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *Citripestis sagittiferella* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name of the pest as search term. Papers relevant for the pest categorisation were reviewed, and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, online), the CABI databases and scientific literature databases as referred above in Section 2.1.1.

Data about the import of commodity types that could potentially provide a pathway for the pest to enter the EU and about the area of hosts grown in the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

The Europhyt and TRACES databases were consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. TRACES is the European Commission's multilingual online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Up until May 2020, the Europhyt database managed notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020.

2.2. Methodologies

The Panel performed the pest categorisation for *Citripestis sagittiferella*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018), the EFSA guidance on the use of the weight of evidence approach in scientific assessments (EFSA Scientific Committee, 2017) and the International Standards for Phytosanitary Measures No. 11 (FAO, 2013) and No. 21 (FAO, 2004).

The criteria to be considered when categorising a pest as an EU-regulated quarantine pest (QP) is given in Regulation (EU) 2016/2031 article 3. Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. In judging whether a criterion is met the Panel uses its best professional judgement (EFSA Scientific Committee, 2017) by integrating a range of evidence from a variety of sources (as presented above in Section 2.1) to reach an informed conclusion as to whether or not a criterion is satisfied.

The Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, deemed to be a risk management decision, the Panel will present a summary of the observed impacts in the areas where the pest occurs, and make a judgement about potential likely impacts in the EU. Whilst the Panel may quote impacts reported from areas where the pest occurs in monetary terms, the Panel will seek to express potential EU impacts in terms of yield and quality losses and not in monetary terms, in agreement with the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Article 3 (d) of Regulation (EU) 2016/2031 refers to unacceptable social impact as a criterion for quarantine pest status. Assessing social impact is outside the remit of the Panel.

Table 1: Pest categorisation criteria under evaluation, as defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest (article 3)
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future.
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?
Available measures (Specific import requirements) (Section 3.6)	Are there measures available to prevent the entry into the EU such that the likelihood of introduction becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether 1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and 2) if not, which one(s) were not met.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pest established, or has it been shown to produce consistent symptoms and/or to be transmissible?

Yes, the identity of the species is established and *Citripestis sagittiferella* Moore is the accepted name.

The citrus pulp borer, *Citripestis sagittiferella* Moore (1891) (Figures 1 and 2) is a Lepidopteran of the family Pyralidae originally called *Nephopteryx sagittiferella*, when first described by Moore in 1891 from specimens captured in Perak (Malaysia) (Moore, 1891). This species had been also known as *Crocidomera robusta* Moore (1886) (Pagden, 1931). *Mussidia pectinicornella* (Hampson, 1896) (= *Citripestis pectinicornella* (Hampson, 1896)), a pest of Fabaceae, had been incorrectly synonymised with *C. sagittiferella* for some years (DROPSA, 2016).

Figure 1: *Citripestis sagittiferella*: (a) larva (b) damage on citrus (©David Crossley, UK Crown courtesy of Fera)

The EPPO code[1] for this species is: CITPSA (EPPO, online).

3.1.2. Biology of the pest

The biology of *C. sagittiferella* has been described by Moore (1891), Pagden (1931) and Clausen (1933). This is an oligophagous species feeding on Rutaceae, mostly *Citrus* spp. (CABI CPC).

Oviposition takes place on the fruit surface at any stage of growth. Five larval instars, which occur in the citrus fruit, follow. Pupation takes place within a cell in the soil beneath the tree. Several generations per year may occur in its native tropical range. The whole life cycle takes from 23 to 30 days (Pagden, 1931).

Table 2: *Citripestis sagittiferella* life cycle.

Life stage	Phenology and relation to host	Other relevant information (Clausen, 1933; Anderson, 2012)
Egg	Scale-like eggs are laid singly or in small clusters upon the surface of the fruit at any stage of growth.	In its native range, the incubation of the egg takes 5–6 days
Larva	Upon hatching, young larvae (2.5 mm long) bore into the fruit rind. After first moult, second instar larvae (4 mm long) dig deeper into the pulp and bore the fruit producing one or more openings (2–3 mm diameter) where frass and drying sap accumulate. Fifth instar larvae (16 mm long) abandon the fruit to pupate in the soil. Fruit infested by several larvae may fall before larval development is completed.	In its native range, larval development takes 9–19 days.
Pupa	Pupation takes place 2 days after construction of the cocoon	In its native range, pupation takes 9–11 days
Adult	Oviposition takes place on citrus fruit only, with a marked preference for pomelo (*C. maxima*), though all *Citrus* species are attacked. The species occurs all year round under tropical conditions in its native range	Multivoltine in its native range. Very quiet at daytime. Probably long-lived (Moore, 1891).

3.1.3. Host range

C. sagittiferella is an oligophagous species feeding on *Citrus* spp. (i.e. *C. aurantifolia*, *C. aurantium*, *C. limon*, *C. maxima*, *C. medica*, *C. reticulata*, *C. sinensis*, *C. paradisi*, *C. hystrix*) (CABI CPC). No information on other Rutaceae species has been found. References to other families (i.e. Cesalpinaceae, Fabaceae) are attributed to an incorrect synonymisation with *M. pecticornella* (see Section 3.1.1).

3.1.4. Intraspecific diversity

There are no reports of intraspecific variation for *C. sagittiferella*.

3.1.5. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, there are detection and identification methods for *C. sagittiferella.*

Detection

Although the main components of *C. sagittiferella* sex pheromone have been identified, no effective lures have been developed (Dung et al., 2021). Therefore, detection relies on observation of damaged fruit.

[1] An EPPO code, formerly known as a Bayer code, is a unique identifier linked to the name of a plant or plant pest important in agriculture and plant protection. Codes are based on genus and species names. However, if a scientific name is changed, the EPPO code remains the same. This provides a harmonised system to facilitate the management of plant and pest names in computerised databases, as well as data exchange between IT systems (Griessinger and Roy, 2015; EPPO, 2019).

Symptoms

Larval damage can be easily observed. After first moult, when the citrus pulp is attacked, one to several holes 2–3 mm in diameter where large amounts of drying sap and excrements accumulate can be detected. Where a considerable number of larvae are present in a single fruit, these accumulations give it a very unsightly appearance upon the tree (Clausen, 1933).

Identification (Anderson, 2012).

- Definitive characters that distinguish larval *C. sagittiferella* from other pyralids have not been clarified. However, no other pyralid in SE Asia/Australasia is known to live in citrus fruits. Hence, a pyralid larva in a citrus fruit is probably a good characteristic of this species. There is another lepidopteran citrus fruit borer, the citrus rind borer *Prays endocarpa* Meyrick (Lepidoptera, Yponomeutidae), which may be confused with *C. sagittiferella*. However, pyraloid larvae only have the following characters: two prespiracular setae on prothorax; crochets in a circle or penellipse (aquatic immatures have 2 rows); three subventral setae on abdominal segments 3–6 and sclerotised ring around base of seta SD1 on segment 8.
- Distinctions between genera have not been evaluated. Genitalia comparisons will usually determine species. The antenna of males of *Citripestis* is pectinate which will distinguish them from most other phycitine genera. Association with Rutaceae provides additional support for *Citripestis*. Definitive diagnosis of this species would rely on comparison of male or female genitalia with representative specimens or DNA analysis.
    - Male genitalia: transtilla not sclerotised; valva with a ventral row of sclerotised ridges; clasper absent; aedeagus without cornuti.
    - Female genitalia: bursa and ductus bursae not sclerotised; signum absent; ductus seminalis from distal half of bursa (Roesler, 1983).

Description (full description available in Pagden, 1931, and Anderson, 2012)

- Adult Grey brown moth, with a wingspan of about 27 mm. The forewings are yellowish or greyish-brown with darker scales along the veins and with a poorly marked median band (CABI, 2021). Hindwings somewhat transparent (Anderson, 2012).
- Eggs. Oval, dirty white, translucent with fine raised irregular networking, lay singly and in small irregular patches on the lower side of the fruit (Anderson, 2012).
- Larvae. Reddish yellow and turn dark green upon pupation. Initially, larvae are gregarious but then separate and burrow into the pulp and pith of fruit. As larvae increase in size, they eat their way through the fruit and create holes used for ejecting refuse; larvae are fast moving and jump and twist when touched. The mature larva drops to the ground by silken threads and burrows into the soil at a depth of approximately 1–2 cm. It then constructs cells of agglutinated earth lined with white silk measuring 0.7 inch in length, 0.4 inch in breadth and 0.3 inch in depth (Anderson, 2012).
- Pupa. Typical obtect adecticous, about 14 mm long.

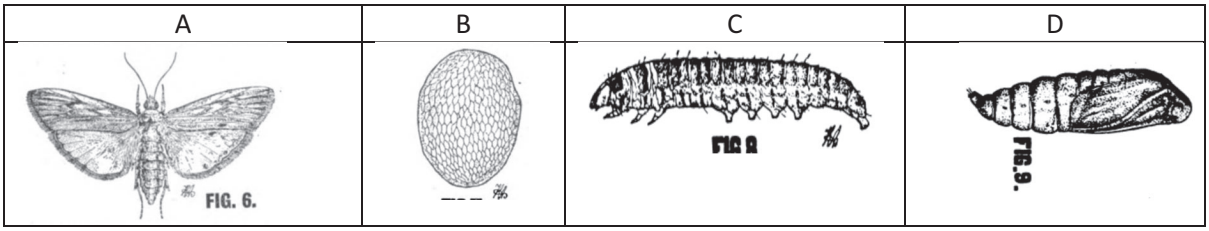

Figure 2: *Citripestis sagittiferella* morphology (Pagden, 1931). A. Adult female (wingspan: 28 mm). B. Egg (1.25 mm long). C. Larva (16 mm long). D. Pupa removed from cocoon (14 mm long)

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

In 1931, Clausen reported *C. sagittiferella* from Malaysia and Indonesia, particularly at lower elevations, though in Sumatra a few infested pomelo fruits were observed at Kahen Djahe, at an

elevation of 1,200 m above sea level (Clausen, 1933). Nowadays, this species is also known to occur in Brunei Darussalam, Singapore, Thailand, Vietnam and The Philippines (CABI CPC; FERA, 2013; Le Quoc et al., 2013). It is considered as an emerging pest in Vietnam (Dung et al., 2021). Current distribution of *C. sagittiferella* is shown in Figure 3. and the details about the locations with references are available in the table of Appendix B.

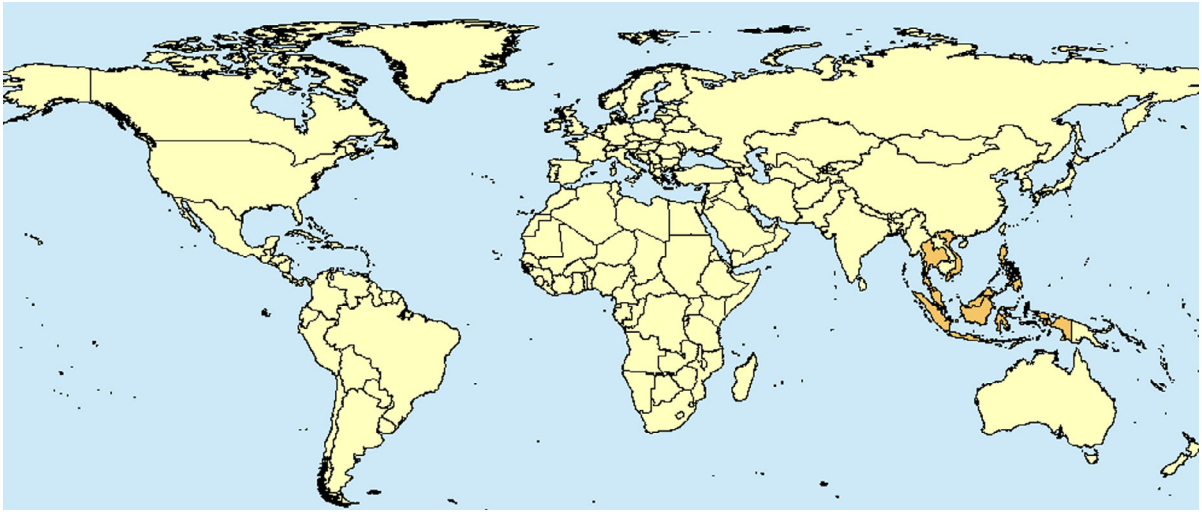

Figure 3: Global distribution of *Citripestis sagittiferella* (Source: CABI database and literature)

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?

No. *C. sagittiferella* is not known to occur in the EU.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

C. sagittiferella is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, the implementing act of Regulation (EU) 2016/2031.

3.3.2. Hosts of *C. sagittiferella* that are prohibited from entering the Union from third countries

Table 3: List of plants, plant products and other objects that are *Citripestis sagittiferella* hosts whose introduction into the Union from certain third countries is prohibited (Source: Commission Implementing Regulation (EU) 2019/2072, Annex VI)

List of plants, plant products and other objects whose introduction into the Union from certain third countries is prohibited			
	Description	**CN Code**	**Third country, group of third countries or specific area of third country**
11.	Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf. and their hybrids, other than fruits and seeds	ex 0602 10 90 ex 0602 20 20 ex 0602 20 30 ex 0602 20 80 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 50	All third countries

List of plants, plant products and other objects whose introduction into the Union from certain third countries is prohibited			
	Description	**CN Code**	**Third country, group of third countries or specific area of third country**
		ex 0602 90 70 ex 0602 90 91 ex 0602 90 99 ex 0604 20 90 ex 1404 90 00	
19.	Soil as such consisting in part of solid organic substances	ex 2530 90 00 ex 3824 99 93	Third countries other than Switzerland
20.	Growing medium as such, other than soil, consisting in whole or in part of solid organic substances, other than that composed entirely of peat or fibre of *Cocos nucifera* L., previously not used for growing of plants or for any agricultural purposes	ex 2530 10 00 ex 2530 90 00 ex 2703 00 00 ex 3101 00 00 ex 3824 99 93	Third countries other than Switzerland

3.4. Entry, establishment and spread in the EU

3.4.1. Entry

Is the pest able to enter into the EU territory? If yes, identify and list the pathways. Comment on plants for planting as a pathway.

Yes, *C. sagittiferella* could enter the EU territory. Although there are no records of interception in the Europhyt database, this species was intercepted at least three times in the UK during the last decade (DEFRA, 2013). Plants for planting with soil can be a pathway for pupae of *C. sagittiferella*.

Adults of *C. sagittiferella* are unlikely to be carried by either plants for planting, flowers or fruit because they would fly off when disturbed during harvesting and processing for shipment. Therefore, *C. sagittiferella* is more likely to move in international trade as immature stages on fruit (eggs), in fruit (larvae) and in soil attached to roots (pupae) of citrus plants, either as a commodity on its own, or when accompanying plants for planting. However, the import into the EU of citrus plants for planting is prohibited (Annex VII, 11.). Moreover, the import of soil (either as such or attached to plants or machinery) from countries where *C. sagittiferella* occurs is also prohibited (Annex VI 19. and 20. and Annex VII 2.). Nevertheless, the import of citrus fruit from third countries is permitted and regulated (Annex VII 57. to 62.). In the period 2016–2020, around 30000 tons of citrus were imported into the EU (27) from countries where *C. sagittiferell*a is known to occur (Figure 4; Appendix A). Most of these imports corresponded to Vietnam (98%), followed by Thailand and Indonesia (1% each). A search of interceptions in Europhyt and TRACES databases did not reveal any interception of *C. sagittiferella* for the period 1995–2021 (accessed on 14 April 2020). According to DEFRA (2013), *C. sagittiferella* was intercepted in the UK in 2011 in fruit of *C. aurantifolia* (Key lime) from Malaysia. There were a further two suspect findings, both from Malaysia, on fruit of *C. latifolia* (Persian lime) and *Citrus* sp., but adults could not be reared to confirm the species from either sample. Additionally, in 2013, another suspected larva of *C. sagittiferella* was found in an orange by a member of the public in London, who took it to the Royal Horticultural Society for identification. Therefore, fruit is a potential entry pathway for *C. sagittiferella* into the EU (Table 4).

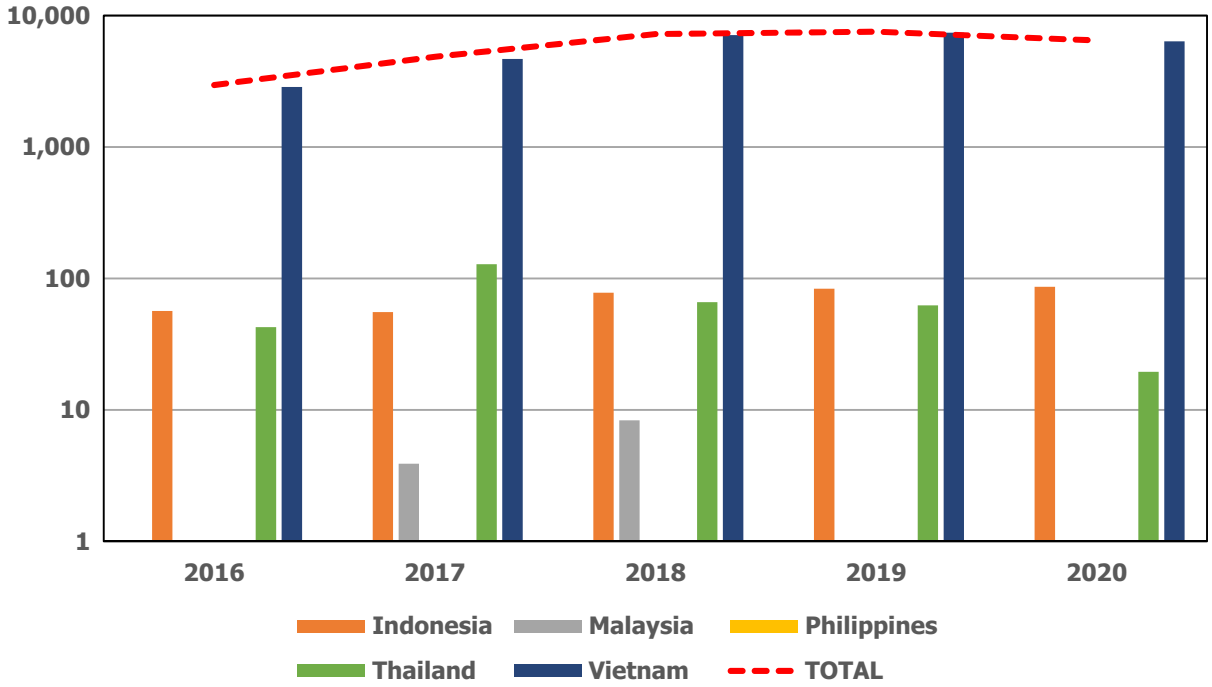

Figure 4: Fruit imported (×1,000 kg) into the EU (27) from countries where *Citripestis sagittiferella* is known to occur (note the logarithmic scale used)

Table 4: Potential pathways for *Citripestis sagittiferella* into the EU 27

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI) or special requirements (Annex VII) within Implementing Regulation 2019/2072]
Fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf. and their hybrids	Egg, larva	Annex VII (57.) requires fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf. and their hybrids from third countries to be free from peduncles and leaves and the packaging shall bear an appropriate origin mark. Annex VII (58.) requires fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids from third countries to be free from *Xanthomonas citri* pv. *aurantifolii* (Schaad et al.) Constantin et al. and *Xanthomonas citri* pv. *citri* (Hasse) Constantin et al. Annex VII (59.) requires fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids from third countries to be free from *Pseudocercospora angolensis* (T. Carvalho & O. Mendes) Crous & U. Braun. Annex VII (60.) requires fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids from third countries to be free from *Phyllosticta citricarpa* (McAlpine) Van der Aa. Annex VII (61.) requires fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids from third countries to be free from Tephritidae (non-European). Annex VII (62.) requires fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids from third countries to be free from *Thaumatotibia leucotreta* (Meyrick). Annex XI A (5.) requires Phytosanitary Certificate for fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., *Microcitrus* Swingle, *Naringi* Adans., *Swinglea* Merr. and their hybrids from third countries other than Switzerland.

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI) or special requirements (Annex VII) within Implementing Regulation 2019/2072]
Plants for planting of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf. and their hybrids	Pupa	Annex VI (11.) bans the introduction of plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf. and their hybrids, other than fruits and seeds from all third countries.
Soil and growing media	Pupa	Annex VI (19. & 20.) bans the introduction of soil and growing media as such into the Union from third countries other than Switzerland
Soil on machinery	Pupa	Annex VII (2.) Official statement that machinery or vehicles are cleaned and free from soil and plant debris

3.4.2. Establishment

Is the pest able to become established in the EU territory?

Yes, *C. sagittiferella* would most probably be able to establish in the EU. It could establish in the citrus growing regions of the EU.

Climatic mapping is the principal method for identifying areas that could provide suitable conditions for the establishment of a pest taking key abiotic factors into account (Baker et al., 2000). Availability of hosts is considered in Section 3.4.2.1. Climatic factors are considered in Section 3.4.2.2.

3.4.2.1. EU distribution of main host plants

As noted above (Section 3.4.1), *C. sagittiferella* is an oligophagous species feeding on *Citrus* spp. fruits. In the EU, citrus production concentrates in Mediterranean countries (Figure 5). Citrus production in the EU is shown in Table 5.

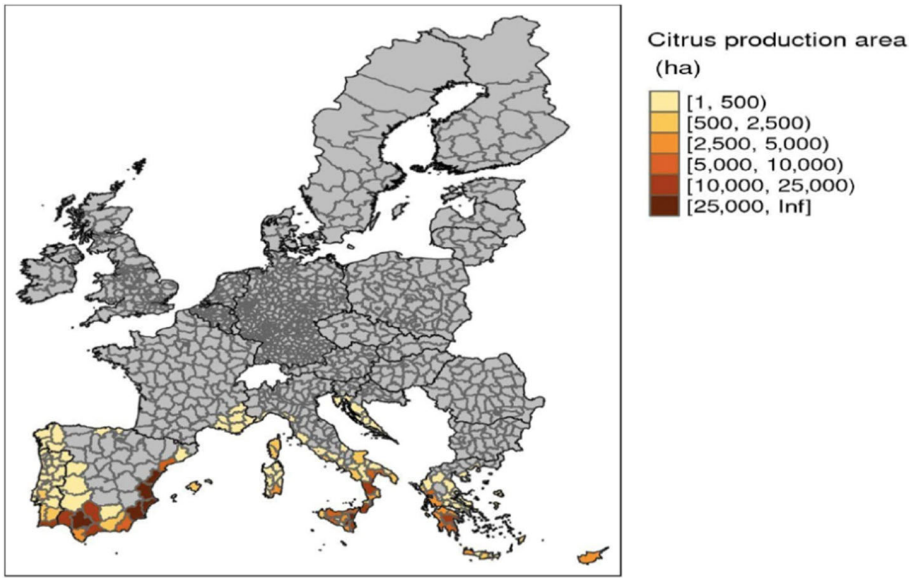

Figure 5: Citrus-growing regions based on citrus production data from national statistical databases at NUTS3 level (EFSA PLH Panel, 2014)

Table 5: Citrus fruit production in the EU (x1000 ha) (source Eurostat, code T0000) (accessed on 27/4/2021)

MS/Year	2016	2017	2018	2019	2020
EU (27)	519,01	502,84	508,99	512,53	487,08
Spain	295,33	294,26	297,62	296,48	297,97
Italy	147,65	135,36	134,64	140,74	113,80
Greece	45,86	43,47	46,26	44,23	44,48
Portugal	20,36	20,51	21,07	21,07	21,07
France	4,22	4,27	4,39	4,61	4,69
Cyprus	3,41	2,92	3,05	3,20	3,04
Croatia	2,19	2,06	1,97	2,20	2,04

3.4.2.2. Climatic conditions affecting establishment

C. sagittiferella is native to tropical Asia, in an area where two climate types also occurring in the EU (Cfb, temperate oceanic, and BSh, hot semi-arid) can be found (Figure 5). Cfb is restricted to the highlands of Sumatra, The Philippines and New Guinea, whereas BSh is even more restricted and can be found in a few spots in this area (Figure 7). In the EU, these two climates occur in areas where citrus are grown. On the one hand, citrus, mostly non-commercial orchards, can be found in areas with Cfb climate (i.e. northern Spain). On the other hand, regular commercial citrus orchards can be found in areas with BSh climate (i.e. eastern and southeastern Spain and eastern Cyprus) (Figures 6, 8). Therefore, these areas may be suitable for establishment of *C. sagittiferella*, should this species enter the EU. Although there is uncertainty on whether *C. sagittiferella* actually occurs in areas with Cfb and BSh climates in its area of origin, it should be kept in mind that other insects with similar abiotic requirements (i.e. the citrus leafminer, *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae)), successfully established in all citrus-growing regions of the EU several decades ago (Karamaouna et al., 2010).

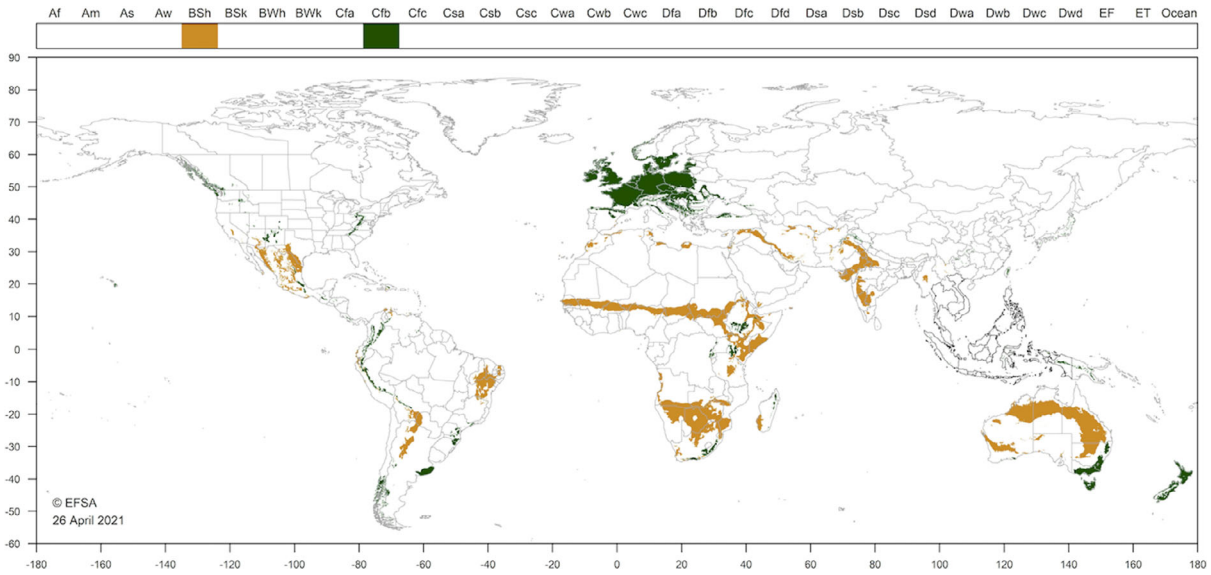

Figure 6: Occurrence of Cfb and BSh climates in the World

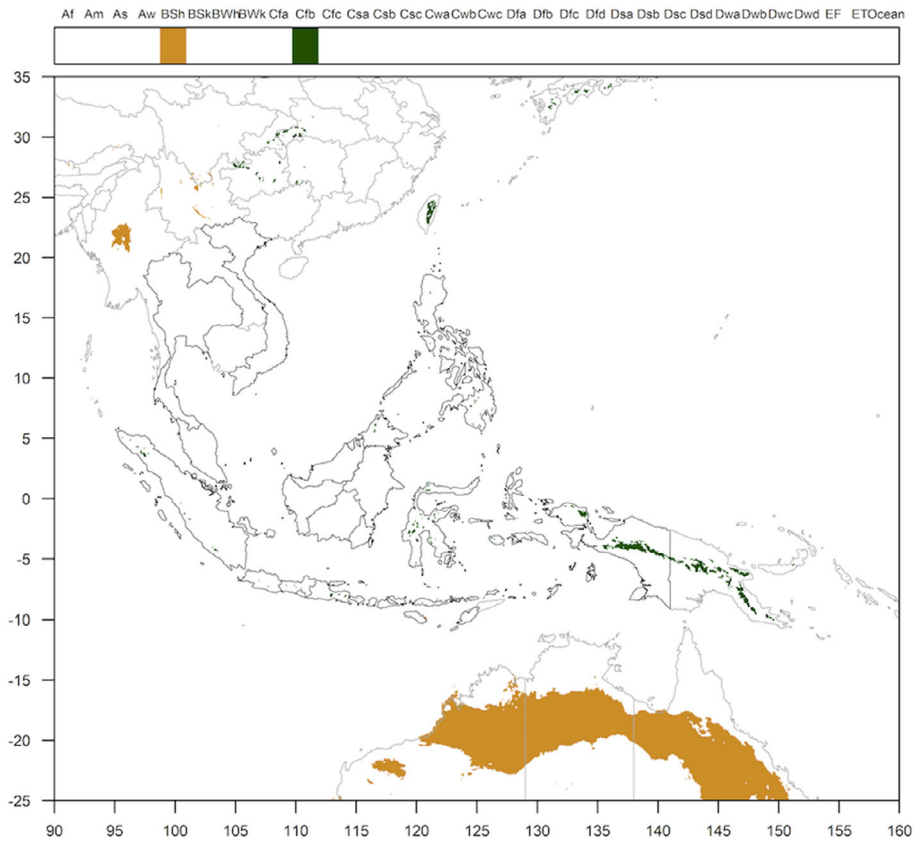

Figure 7: Occurrence of Cfb and Bsh climates in the area of origin of *Citripestis sagittiferella*

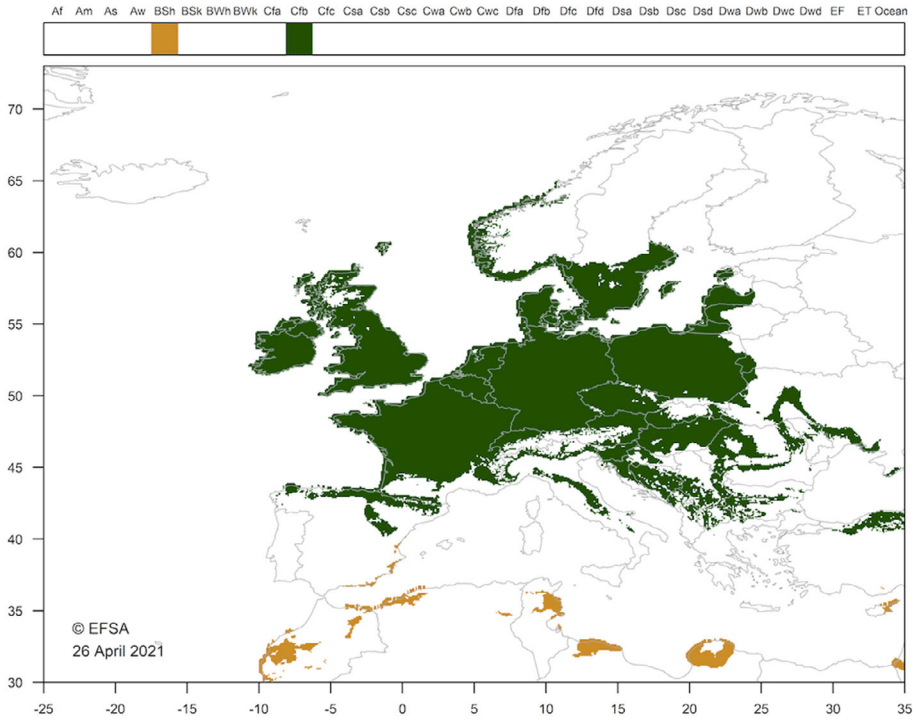

Figure 8: Occurrence of Cfb and Bsh climates in the EU

3.4.3. Spread

Describe How the pest would be able to spread within the EU territory following establishment?

Le Quoc et al. (2013) and Dung et al. (2021) report *C. sagittiferella* spreading in Vietnam, Thailand, Indonesia, and The Philippines. This insect could spread by itself as adults (flying moths); spread could also be human-assisted as immature larvae in infested produce (citrus fruit).

Comment on plants for planting as a mechanism for spread.

Because *C. sagittiferella* pupates in the soil (see Section 3.1.2), plants for planting with soil attached to its roots could provide a mechanism for spread.

3.5. Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory?

Yes, the introduction of *C. sagittiferella* would most probably have an economic impact on the EU territory.

According to Hussein and Rahman (1981), *C. sagittiferella* is considered the most destructive insect pest of pomelo (*C. maxima*) and lemon (*C. limon*) fruits in Malaysia (Pagden, 1931; Yunus and Balasubramaniam, 1975). In tropical Asia, the pest is by far the most injurious of all the insect species which attack citrus fruits (Clausen, 1933). Larval feeding inside the fruits cause fruit loss that can reach more than 70% in grapefruit and oranges (FERA, 2013; Dung et al., 2021). Moreover, entry of pathogens can cause secondary fruit rot (FERA, 2013). It is one of the most important moths in Malaysia and Indonesia, especially on grapefruit at low altitude (Reuther, 1989).

3.6. Available measures and/or potential specific import requirements and limits of mitigation measures

Are there measures available to prevent the entry into the EU such that the risk becomes mitigated?

Yes, citrus plants from third countries are banned from entering into the EU (see Sections 3.3.2 and 3.4.2). Citrus fruit require a phytosanitary certificate (see Section 3.4.2) and could be further sourced from areas free of *C. sagittiferella* (see Section 3.6.1).

3.6.1. Identification of potential additional measures

Phytosanitary measures are applied to citrus plants for planting and soil (see Section 3.3 for prohibitions and Section 3.4.2 for specific requirements on pathways). Therefore, these entry pathways can be considered as closed. However, regulations applied to the citrus fruit pathway (see Section 3.4.2), do not specifically consider *C. sagittiferella*. As citrus fruit are not prohibited for import, potential additional measures are listed in Table 6.

Table 6: Potential additional measures (a full list is available in EFSA PLH Panel, 2018) to mitigate the likelihood of pest entry

Special requirements/measures (with hyperlink to summary information sheet if available)	**Control measure summary in relation to *Citripestis sagittiferella***
Pest freedom	Pest free area. Used to mitigate likelihood of infestation by specified pest at origin, hence to mitigate entry
Inspections	Fresh produce could be inspected for symptoms. Could inspect plants for planting in field before and at export
Phytosanitary certificate and plant passport	Used to attest which of the above requirements have been applied

3.6.1.1. Biological or technical factors limiting the effectiveness of measures to prevent the entry of the pest

- Eggs are minute and may be difficult to detect
- Larvae burrow inside fruit; infested fruit might not be detected during inspections of imports
- Pupae could be hidden in the roots/growing medium of host plants
- Adults could be present as hitchhikers even on non-host plants
- Adults can actively fly

3.7. Uncertainty

The main uncertainty refers to the climatic requirements of *C. sagittiferella*. As pointed out in Section 3.4, whether this species actually occurs in places with Cfb and BSh climates in its area of origin remains unknown. Clausen (1933) reported the occurrence of infested pomelos in Sumatra at 1,200 m above sea level. Moreover, there is evidence of pests with similar biotic and abiotic requirements which eventually established in the Mediterranean Basin (i.e. *P. citrella*). Therefore, there is uncertainty about the establishment of *C. sagittiferella* in the EU.

4. Conclusion

C. sagittiferella satisfies the criteria that are within the remit of EFSA to assess for this species to be regarded as a potential Union quarantine pest. There is uncertainty about the climatic requirements of this species, which may hamper its establishment in the EU. Pest categorisation conclusions are presented in Table 7.

Table 7: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of *Citripestis sagittiferella* is well established.	
Absence/presence of the pest in the EU (Section 3.2)	*C. sagittiferella* is not known to occur in the EU territory.	
Regulatory status (Section 3.3)	*C. sagittiferella* is currently not regulated in the EU.	
Pest potential for entry, establishment and spread in the EU (Section 3.4)	*C. sagittiferella* could enter into, establish in, and spread within the EU territory. Main pathways are: • Plants for planting of *Citrus* spp. • Soil and growing medium as such or attached to machinery. • *Citrus* spp. fruit.	There is uncertainty about the climatic requirements of *C. sagittiferella*, which may hamper its establishment in the EU.
Potential for consequences in the EU (Section 3.5)	Should *C. sagittiferella* be introduced into the EU, an economic impact would most likely follow.	
Available measures (Section 3.6)	There are measures to prevent the entry, establishment and spread of *C. sagittiferella* within the EU territory, such as sourcing plants for planting from PFA.	
Conclusion (Section 4)	*C. sagittiferella* fulfils all criteria assessed by EFSA above for consideration as a quarantine pest.	
Aspects of assessment to focus on/scenarios to address in future if appropriate:		

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Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
HRP	high-risk plants
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health
QP	quarantine pest
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2018).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2018).
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2018).
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2018).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2018).
Greenhouse	A walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment.
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units.
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2018).
Pathway	Any means that allows the entry or spread of a pest (FAO, 2018).
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2018).
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2018).

Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager.
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2018).

Appendix A – EU 27 Imports of citrus fruit (in 100 Kg) from countries where *C. sagittiferella* is known to occur (Indonesia, Malaysia, Philippines, Thailand, and Vietnam)

Data from the Eurostat (Easy Comext accessed on 27 April 2021)

Summary: EU 27 imports of fresh or dried citrus fruit (Hundreds of kg)

Source	2016	2017	2018	2019	2020	5 year Sum	%
Vietnam	28,649.46	46,738.17	70,934.07	73,964.35	63,728.03	284,014.08	97.62
Indonesia	566.73	555.70	779.35	836.73	864.54	3,603.05	1.24
Thailand	426.42	1,283.13	659.74	624.93	194.87	3,189.09	1.10
Malaysia	4.18	39.02	83.45	7.71		134.36	0.05
Philippines		0.00	0.20	7.71	0.10	8.01	0.00
Singapore		0.00				0	0.00
Brunei Darussalam		0.00				0	0.00
Sum	29,646.79	48,616.02	72,456.81	75,441.43	64,787.54	290,948.59	100.00

Indonesia

Member state/Year	2016	2017	2018	2019	2020
Czechia				3	
France	276.58	416.43	421.68	543.84	684.5
Germany	7.4				1.8
Netherlands	282.75	139.27	357.67	289.49	178.24
Portugal				0.4	
Total	566.73	555.7	779.35	836.73	864.54

Malaysia

Member state/Year	2016	2017	2018	2019	2020
Czechia	0.6				
France	3.58	38.66	70.18	7.71	
Netherlands		0.36	13.27		
Total	4.18	39.02	83.45	7.71	0

Philippines

Member state/Year	2016	2017	2018	2019	2020
Netherlands				3.73	
Spain				1.36	
Sweden			0.2	2.62	0.1
Total	0	0	0.2	7.71	0.1

Thailand

Member state/Year	2016	2017	2018	2019	2020
Austria	1.2		0.01	16.04	
Croatia		90		90	100
Czechia	12.46	18.3	42.18	45.72	12.25
Denmark			0.19		
Finland	0.1				

Member state/Year	2016	2017	2018	2019	2020
France	15	13	13.9	4.54	2.4
Germany	18.26	15.33	45.92	2.33	3.17
Italy	180.95	170.03	341.03	77.38	77.03
Netherlands	191.04	971.58	216.41	385.75	
Poland	0.14				
Slovakia				0.01	0.02
Slovenia				0.01	
Sweden	7.27	4.89		3.15	
Total	426.42	1283.13	659.64	624.93	194.87

Vietnam

Member state/Year	2016	2017	2018	2019	2020
Bulgaria	110				
Czechia	876.31	1,036.27	490.14	848.94	1,017.81
France		0.1	1,527.14	1,366.86	198.53
Germany	36	54.18	154	57.6	350.41
Hungary					0.05
Ireland			0.83		
Italy	110			317.24	
Netherlands	27,517.09	44,362.34	60,998.09	64,135.70	58,773.23
Poland		1,249.60	7,747.26	7,238.00	3,388.00
Slovakia		35.64	16.61		
Spain	0.06				
Total	28,649.46	46,738.13	70,934.07	73,964.35	63,728.03

Appendix B – Distribution of *Citripestis sagittiferella*

Distribution records based on different sources are presented in the table below.

Region	Country	Sub-national (e.g. State)	Status	Reference
North America			No records, presumed absent	
Central America			No records, presumed absent	
Caribbean			No records, presumed absent	
South America			No records, presumed absent	
Europe			Intercepted only, presumed absent	DEFRA (2013)
Africa			No records, presumed absent	
Asia	Brunei			Waterhouse (1993), CABI CPC
	Indonesia	Java, Sumatra		Roesler (1983), Clausen (1933)
	Malaysia	Peninsular Malaysia, Sabah		CABI (undated), Roesler (1983), Robinson et al. (1994), Clausen (1933)
	The Philippines			Le Quoc et al. (2013)
	Singapore			Waterhouse (1993), FERA (2013)
	Thailand			CABI (CPC), FERA (2013)
	Vietnam			Le Quoc et al. (2013)
Oceania			No records, presumed absent	